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Commodity boom: More than just risk for German industry

A growing world population and an expanding global economy point to increasing demand for raw materials and therefore to higher prices in the longer term. For industrialised countries like Germany, this means, on the one hand, higher raw material procurement costs. On the other hand, many industrial sectors will gain new and increasingly wealthy customers. These will not only be the new raw materials exporters but also countries such as China and India, whose industrialisation is currently driving raw materials prices.

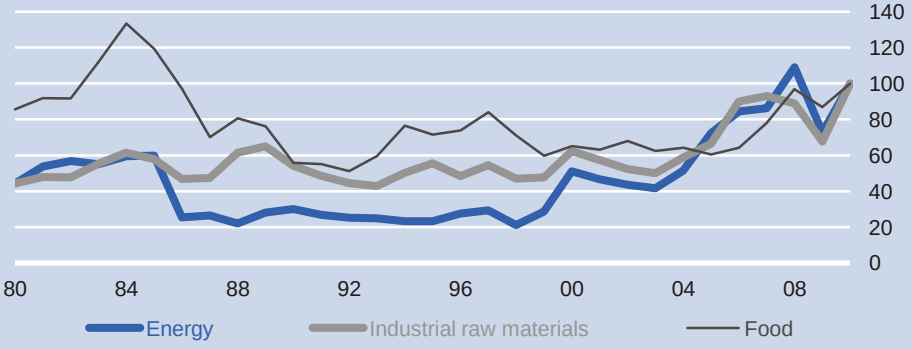
For industry, higher material and energy costs are not only a burden. Observant companies will not put up with victim status: they will take advantage of novel opportunities on the newly-opening markets. For instance, regions of global economic growth have long since been new target markets for sectors such as the German automobile industry and many sectors of mechanical engineering.

The impact of the raw materials cycle on industries depends on their ability to pass on cost rises. For instance, in upswings the chemical and steel industries can often easily pass on higher costs through their selling prices: typically, raw materials prices are relatively high at that point of the cycle – but so is demand from important customers like the motor vehicle industry.

The varied challenges presented by increasing raw materials prices call for an optimal division of labour between firms and politicians. Domestic industries' concerns about their raw material sources need to be taken seriously. EU policies have a special responsibility to develop a cross-departmental approach. The latest EU initiatives show increased sensitivity and are heading in the right direction as they intend to improve access to energy feedstock while also reducing the consumption of raw materials.

Rising raw material prices: A challenge for German industries

Raw material prices, EUR basis, 2010=100



Source: HWWI

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Dependence on raw materials is once again a hot topic

The degree of interest in raw materials shown by the media and large parts of the population is asymmetric.

— In times of global economic weakness, raw materials are relatively seldom discussed. During the most recent global recession, for instance, there was little media coverage of the prices of energy feedstock, food and non-ferrous metals.

— In subsequent recovery phases, such as recently, things are very different: the global economy has undergone a "V"-shaped – i.e. very fast – recovery and commodity prices have shot up again. Because of that the interests of the general public was once more particularly focussed on the prices of food, energy feedstock, such as oil and gas, and precious metals.

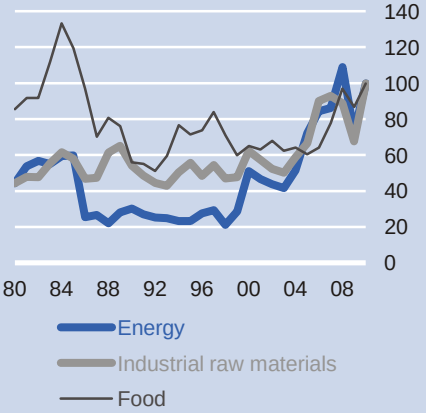
Raw materials back in the media spotlight

Beyond this media coverage, and long forgotten by many contemporaries, in this upswing there were some special trends that amazed even the experts. Not least, at the start of the global economic recovery it was enough that China wanted to take advantage of its quasi-monopoly role by putting stronger controls on the export of rare earths. As a result, the business models of many industrial firms – and even the economic prosperity of some countries – were perceived to be permanently jeopardised.

Raw material dependence about more than just rare earths

According to the Chinese statistics office, between the start of 2009 and the end of 2010, i.e. in two years, export prices of Chinese rare earths increased by a factor of 5 on average. However, concentrating just on these materials narrows the overall perspective. Firstly, in terms of quantity, rare earths make up only a tiny proportion of industrial raw material consumption. Secondly, in the period after the global recession, the prices of all other major raw material groups have strongly recovered as well.

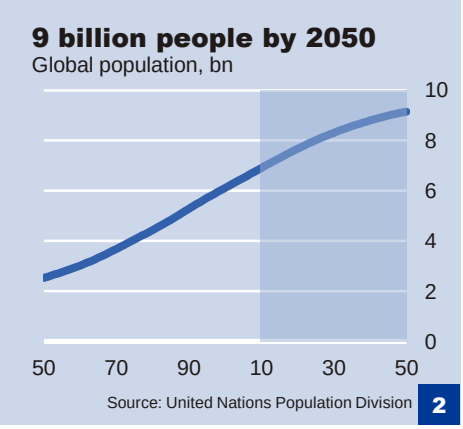
Raw material prices bounced back post-crisis
Commodity prices, EUR basis, 2010=100

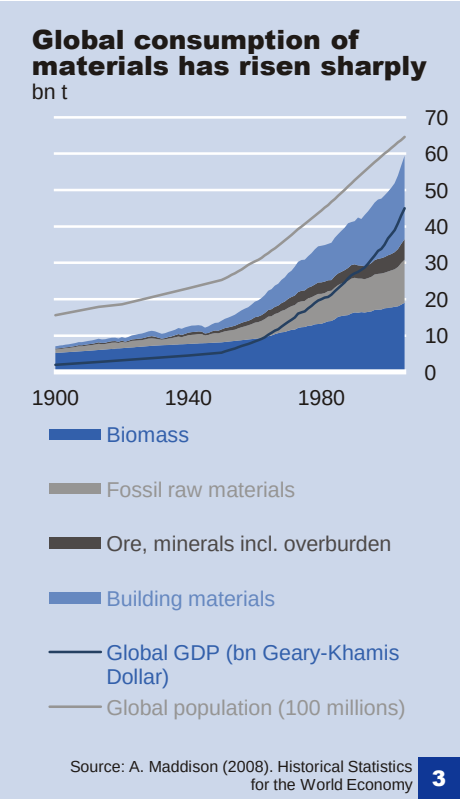


Source: HWWI 1

For instance, between the end of 2008 and July 2011, the HWWI overall commodity price index increased by almost 130%. However, the composite index, which puts a particularly high weighting on energy feedstock (79.2%) and industrial raw materials (15.4%) conceals the differing dynamics of the sub-indices. For example, while the prices of energy feedstock rose by more than 150% and industrial raw materials by more than 80% in the period under consideration, food prices increased by "only" around a half. On balance, it is clear that, important as they are for particular industrial processes or individual products, rare earths in no way reflect overall commodity price developments.

Beyond the ups and downs in the media, in academic and political circles, at least since the first oil crisis in 1973, the subject of commodities has been much more profoundly researched than before. Although in the past there were shortages and anxieties about the supply of individual commodities, such as copper, lead, rubber or rice, never before have the industrialised countries in particular felt so dependent on a handful of raw materials suppliers. The oil producing countries for instance founded OPEC as long ago as 1960, however for many years this supply cartel was regarded as toothless.





Industrialised countries such as Germany, and in particular its companies and politicians, would be well advised not to regard the currently rising commodity prices as a purely cyclical phenomenon but to put more importance on the structural changes and the factors driving them. There is much to suggest, for instance, that the commodity price boom that, up to 2008, was fuelled by economic advances, primarily in the most populous Asian countries China and India but also in many other emerging and transitional countries, will continue in the longer term and will bring a structural increase in demand for commodities. This is because more than 85% of the global population lives in emerging and developing countries, although they account for just over half the annual global consumption of crude oil and three quarters of steel consumption so far. Another factor is the growth in the world population, set to increase by 2.3 billion to 9.1 billion by 2050, as, all other things being equal, more people means more demand for resources. In addition, in countries with low incomes, consumption remains very raw-material intensive. This results in increased demand, not just for higher-quality foodstuffs such as meat but also energy and steel, the production of which swallows up more basic materials.

Moreover, it should not be overlooked that a growing proportion – and an increasing number – of the world population now living in absolute poverty will achieve incomes above subsistence level for the first time in the coming years. This level of income makes the demand for basic, relatively material-intensive products, possible and is by no means restricted to food. Of course, this driver of demand must be assessed positively in terms of an increasingly fair distribution of wealth.

Global demand for raw materials growing dynamically

Global raw material consumption, less than 10 bn tonnes (t) p.a. before 1900, had increased to more than 30 bn t in 1975 and recently to 60 bn t. Increasing raw material consumption (by the factor of 6) is not just a result of global population growth as the population has expanded by only a factor of 4 in that period. Other determinants, such as changing consumption patterns, therefore also play a major role. Average raw material consumption per person in the period of consideration has therefore risen considerably – by a factor of 2 – rising to 9.2 t from its original 4.4 t per person p.a.[1]

Although the indicator of global raw material consumption provides a good overview, for several reasons it is inadequate. Firstly, consumption is not equally distributed among countries. Secondly, the pure raw material consumption does not involve the so-called "ecological commodity rucksack".[2] Thirdly, in this context it is also important that the increasingly international supply chains could

[1] See: Simon, Franz-Georg und Klaus Dosch (2010). Verbesserung der Materialeffizienz von kleinen und mittleren Unternehmen. Wirtschaftsdienst. Heft 11, S. 754/755. Krausmann, Fridolin et al (2009). Growth in global material use, GDP and population during the 20th century. Ecological Economics 68 (10), S. 2696-2705.

[2] This includes unprocessed extracted material (e.g. overburden), waste and other demands on resources occurring in the extraction, production and transport of metals, energy feedstock and biological materials. According to the German Federal Environmental Agency, North America consumes 88 kg of raw materials (including "commodity rucksacks") per person per day, almost twice as much as Europe (43 kg) and nearly nine times as much as Africa (10 kg). See: Umweltbundesamt (2010). Rohstoffeffizienz: Wirtschaft entlasten, Umwelt schonen. Dessau-Rosslau. Simon et al (2010), pp 754/755.

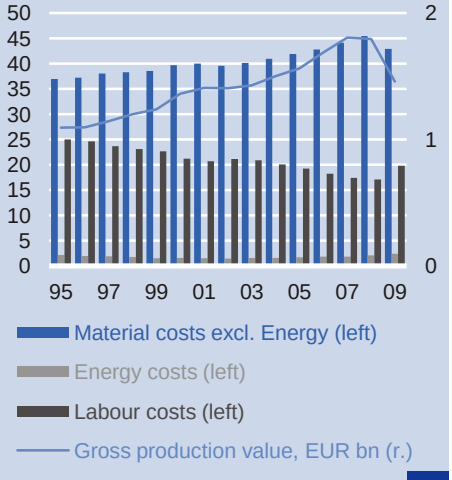
Official statistics for industrial firms' costs

The Federal Statistical Office publishes annual data on the cost structure of industrial firms. These include, for example, information on material and labour costs as well as rental fees incurred in manufacturing products. A comparison of the costs with the gross production value – which admittedly rises over time due to the growth in industrial production – gives the proportion accounted for by each of the cost headings. This enables e.g. a comparison of the burden of rising commodity prices between sectors and over time.

In its 2008 statistics, however, the Statistical Office changed its sector differentiations, resulting in a structural discontinuity in the data that makes it difficult to compare the relative proportions of costs between 1995 and 2008. We have tried to compensate for this discrepancy by using our own calculations. However, the proportions of costs required for our analysis point unambiguously in one direction, confirming the validity of our results.

Share of material costs rose

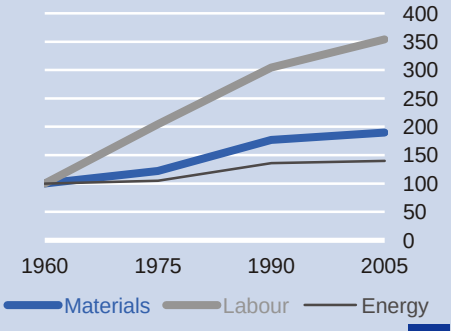
Manufacturing, % of gross production value



Source: Federal Statistical Office 4

Labour productivity has risen considerably

Input of production factors relative to GDP, Germany, 1960=100



Source: Wirtschaftsdienst 11 (2010) 5

result in misinterpretation of commodity consumption in individual countries.[3]

In future there could be noticeable further increases in the problems associated with raw material usage as a result of growth in the global population and the world economy. The industrialised countries with relatively high raw material demands are therefore particularly under pressure to focus even more urgently on the topics of consumption of raw materials and resources, and/or strategies to increase raw material and resource efficiency. Although greater efforts by the developing countries are also to be expected, practicable ways to a more resource-efficient future are most likely to be developed by industrial and technological leaders.

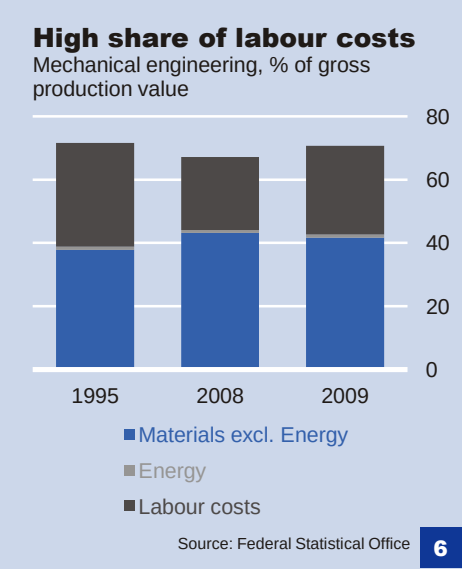
In the last few decades, Germany in particular has gained a very high reputation in this respect, as a testing ground for increased energy efficiency and for new energy concepts and solutions. Nevertheless, Germany's raw material base is nowhere near as slim as many assume. In view of all the above, using Germany, an industrialised country, as an example, our aim is to demonstrate the challenges that a further relative shortage of raw materials – and the ensuing price increases – could bring. After outlining the "new dependence on raw materials"in the **first section**, we will explore the problems of commodities as a cost factor for major German industries in the **second section**. In the **third** and final **main section**, we expand on the important aspects of a forward-looking raw materials policy.

Raw materials are a major cost factor for manufacturing and other sectors

The cost structure of German industry is in flux. Since reunification at the start of the 1990s, the proportion of labour costs has tended to fall, while the proportion of material costs (excluding energy) has risen and the proportion of energy costs has roughly marked time. Many factors were behind this trend. Relatively high labour costs in Germany, for instance, were an incentive to use labour more efficiently. In contrast, relatively low commodity prices in the 1990s were a temptation to put lower emphasis on efficient use of materials and energy. Therefore advances in materials efficiency have been moderate and were nowhere near enough to compensate for rapidly rising commodity prices in the last two decades. Political instruments such as the ecological tax reforms, which came into force on 1 April 1999 and which have eased labour costs while loading energy costs, have also had an effect.

Since the end of the 1990s, however, commodity prices – and therefore also industrial material and energy costs – have risen significantly. It is therefore in the interests of industry to take advantage of all possibilities to curb the raw material use, i.e. the expenditure on materials and energy. In addition, worldwide demand for particularly economical and efficient products is increasing. Materials and energy efficiency are therefore important topics for virtually all industrial sectors, as the following short summary of the major industrial sectors shows.

[3] For instance, the actual raw materials balance sheets for highly-developed industrialised countries often no longer include imports of basic materials that have already been treated and processed, which are additionally loaded by the corresponding "commodity rucksacks".



Mechanical engineering

Between 1995 and 2008, the gross production value of the mechanical engineering sector in Germany increased by 81% to EUR 238 bn. As a result of the recession, it then fell to EUR 181 bn. The global economic cycle resulted in commodity prices falling worldwide. At the same time, the federal government's economic policy, using short time working amongst other measures, ensured that employment remained relatively stable. As a result, the cost structure of manufacturing industry changed markedly between 2008 and 2009. Year-on-year the proportion of material costs fell, while that of labour costs rose. Nevertheless, by long-term comparison the previously described trend toward increasing proportions of material costs and falling proportions of labour costs continued.

In mechanical engineering the proportion of material costs (excluding energy) rose from 37.8% in 1995 to 41.7% in 2009. Energy costs recorded a somewhat more favourable performance with a roughly constant proportion, 1%, at both the beginning and end of this period. In contrast, the proportion of labour costs fell noticeably, from 32.8% to 28.0%, in this sector that is dominated by engineers and skilled staff.

German mechanical engineering is distinguished globally by its particularly wide spectrum of products. In around 30 specialist sectors (e.g. tool making, paper and textile machines but also rolling bearings and lasers for materials processing) it manufactures for customers in many sectors, including automobiles, textiles and clothing. The success of the sector is based not least on raw-material-related foundations. As an industrial location, Germany enjoyed from the beginning a favourable manufacturing network. Initially it was above all coal and steel, which formed the material backbone of mechanical engineering. This was coupled with a well-developed aptitude for finding technical solutions to the pressing problems of the time. Depending on the individual segment (e.g. construction machinery or optical production technology), the material requirements and technical demands for a particular machine can be very different.

Mechanical engineering wrongly thought to have low dependence on raw materials

Mechanical engineering: Security of supply important

Traditionally, mechanical engineering is not considered to be a sector that is particularly dependent on raw materials, because mechanical engineering workers do not normally work with primary raw materials but rather with materials that have already been processed. Of quantitative importance is, therefore, not the original raw material, iron ore, but the quality steels made from it. As well as steel, raw materials from the non-ferrous group of metals (NF metals), in particular aluminium, copper, nickel, zinc, tin, titanium and metal alloys, are also important. For instance, only the use of alloying metals such as nickel, molybdenum and chrome make it possible to produce particularly heat-resistant and/or non-rusting steels. These are not least needed by manufacturers of food processing machinery. As mechanical engineering increasingly makes use of glass and plastics, their primary materials are also indispensable.

The importance of raw materials in modern mechanical engineering is, however, considerably greater than it at first appears. For instance, the manufacturers of carbide tools such as drills and milling cutters need tungsten and/or tungsten oxide in order that the

Mechanical engineering

Industrial firms are affected by rising prices and supply risks of raw materials in different ways. The extent to which they are affected is shown in a text box for each of the sectors covered.

Important raw materials:

Steel, NF metals

Negative:

— Moderate dependence on metals producers

— Threats to supply of rare metals (e.g. tungsten) possible

— High economic dependence on the raw materials cycle

Positive:

— Supplier of raw materials projects

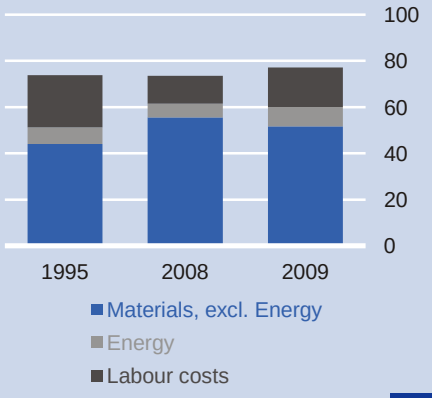
— Supplier of efficient solutions for customers with raw material problems

— Good opportunities for passing on raw material price increases

— Low proportion of material costs

Share of material costs high, labour costs low

Metal manufacturing, % of gross production value



Source: Federal Statistical Office 7

Metals are at the start of many value-added chains

Most industries – from automobiles to mechanical engineering – need metal for their products as well as for their manufacturing processes. The metal industry is therefore at the start of many industrial value-added chains. The firms in this sector produce steel and steel alloys, as well as non-ferrous metals such as copper and aluminium. These are supplied to the various client sectors, mainly in rolled form as so-called coils, as slabs or, after preliminary treatment, as cast workpieces. The most important customers are the construction industry, automotive sector, mechanical engineering, shipbuilding and off-shore industries.

small cutting tools can work even on very hard metal. Although the proportion of raw material may be low, it determines the technical field of application and the efficiency of the tool. Although the volume required may suggest otherwise, the availability of the basic raw material is very important for the operational capability of the carbide tools concerned.

Mechanical engineering aids the raw materials industry …

In many ways, mechanical engineering is also an important partner and trailblazer for the raw materials industry. For instance, the sector equips mining companies worldwide with mining machinery. Efficient textile machinery, in which Germany also holds an important position, makes it possible to process the raw material, cotton, as well as alternative technical textile fibres, at reasonable prices. In addition, mechanical engineering makes reduced energy feedstock use possible. It therefore enables increased efficiency in industry and for many consumer goods.

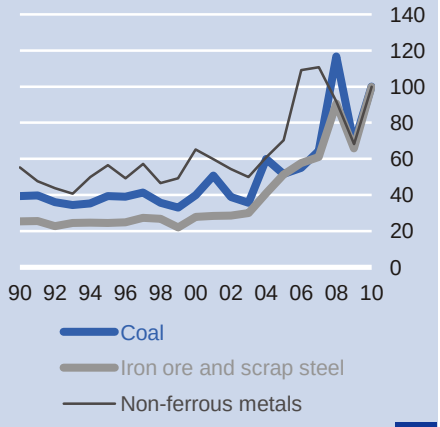
… and remains a trailblazer for increased raw materials efficiency

On balance, the cost structure of mechanical engineering in Germany is likely to undergo further changes in the future. There is much to suggest though that, in the future, machines will still be built of high-quality materials such as high-grade steel. Increasing demand for expertise, with stiffening international competition (e.g. from Chinese mechanical engineers), indicate that the future of German production facilities could lie, above all, in premium, efficient and top-quality machine solutions. However, these cannot be developed and manufactured without having appropriately qualified personnel. In this respect the so-called ecological tax reforms in Germany are aiding mechanical engineering, which is relatively labour-intensive. They ease the burden of labour costs, while making energy consumption more expensive. Nevertheless, in Germany the sector should well continue to be characterised by a relatively high proportion of labour costs. Although technical advances make efficiency gains on material possible, the real potential for savings lies in the use of machines in the customer industries. For instance, modern laser machines enable automobile manufacturers to use thinner bodywork and therefore produce more energy-efficient vehicles. Less metal and plastic per vehicle is therefore needed. Motorists save on fuel costs and there is less strain and burden on the environment. In the foreseeable future, Germany should continue to be the global testing ground for increased raw material and energy efficiency and for new utilisation concepts and solutions.

Mechanical engineering likely to be a net gainer

Netting the likely effects of the advantages and disadvantages of higher raw material prices for mechanical engineering produces surprising results. It is true that higher prices for metals and energy will make the production of each machine more expensive and will therefore put a burden on mechanical engineering. However, it is also a fact that raw material prices on the world markets tend to be rising and/or at a high level during an upswing, i.e. exactly the stage when modernisation or expansion of plant is typically undertaken. Another point is that the raw material producing countries benefit and find it easier to finance investments in mining or energy production. All this benefits German mechanical engineering which, by weighting the few disadvantages and many advantages, can be

Tremendous price increases for metal raw materials
EUR basis, 2010=100



Source: HWWI 8

Chinese growth drives global steel production
Crude steel production, m tonnes

Source: Worldsteel 9

Oyu Tolgoi Mine holds large raw material deposits

The first ore extraction from the Oyu Tolgoi Mine starts in 2012 (11 years after initial discovery). It may be in commercial operation as early as 2013. The mine, in the south of Mongolia, has the potential to become one of the three largest copper and gold mines worldwide. Its geographical location – not least because of its proximity to China – makes the project particularly interesting.

Examples of major raw materials projects

- Important copper mine: Oyu Tolgoi Mine (Mongolia), starting 2012
- Large natural gas deposit: Yamal (Russia), first shipment 2018
- New iron ore mine: Eyre Peninsula (Australia), construction starts 2015
- Rare earths: Mountain Pass Mine (USA), starting later in 2011

certainly count as a beneficiary. By definition, however, the sector is also particularly vulnerable to downturns.

Metal manufacturing

Metal manufacturing is one of the most material-intensive sectors of German industry. In 2009, materials accounted for 51.7% of its overall costs. Also, compared with 1995 (44.1%) its material intensity has sharply increased. The sector incurs the highest proportion of energy costs (7.1% in 1995; 8.3% in 2009) of all industries. In contrast, labour costs have diminished in importance, falling from 22.6% of overall costs in 1995 to 17.2% in 2009.

Dependent on expensive raw materials with volatile prices

The sector's most important raw materials are iron ore, coking coal and conditioned scrap steel. Production of these goods accounts for over 40% of the gross value added by the sector. The dramatic price increases of these raw materials, particularly in the last 8 years, have therefore hit the sector hard and were a major reason for the increasing proportion of material costs. According to the HWWI raw material prices index, the average prices of iron ore and steel scrap more than trebled between 2003 and 2010, while the price of coal almost doubled. The most important factor driving these increases was exploding demand from China. Between 2003 and 2008, global steel production increased from 850 m to 1.3 bn t. Three quarters of the increase was the result of rapid production growth in China, which now accounts for 45% of annual global crude steel production. In 2003 this was only 23%.

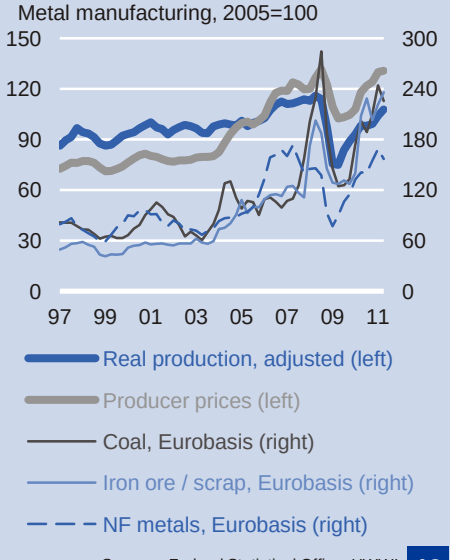
Irrespective of the supply and demand fluctuations that are typical for the sector, a new price mechanism has increased the volatility of the iron ore market.[4] In mid-2010 the major iron traders, who control almost 70% of overseas commerce, cut the length of their supply contracts from 12 to 3 months. This means that, in times of increasing demand, iron ore suppliers will be able to pass on higher prices more quickly to the steel companies. The downside of the shorter contracts for the ore suppliers, however, is that when demand is falling, prices will drop quickly.

Buyers of NF metals have also been confronted by rapidly rising commodity prices. The HWWI price index for non-ferrous metals doubled between 2003 and 2010. However, the index figure hides differing trends. For instance, the price of copper, one of the most important non-ferrous metals, increased more than four-fold between 2003 and 2010. There were similar rises in the markets for lead and tin. In contrast, the price of aluminium, by quantity the most important non-ferrous metal, rose by “only” about 50%.

In view of the trend of rising demand for metallic industrial raw materials, in particular from Asia, the long-term trend of prices could continue to be upward. On the supply side there appear to be no short-term developments that could cushion the rising trend of prices. Typically, the supply side reacts only gradually to higher metal prices, as ore production requires major investment. Nevertheless, in the next few years, major projects start production which shows that there are still considerable global deposits, at least of the most important (in terms of quantity) industrial metals. Admittedly, these have to be developed first which takes time. Despite the possible price-damping effects, there could well be an

[4] See: Fey, Lisa (2010). Turbulence in the steel market. Deutsche Bank Research. Research Briefing. Frankfurt am Main.

Higher costs passed on to customers
Metal manufacturing, 2005=100



Sources: Federal Statistical Office, HWWI 10

excess of global demand in the coming decades, so that – other than in phases of economic recession – rising metal prices can be expected.

The metal industry enables increased material and energy efficiency in client industries

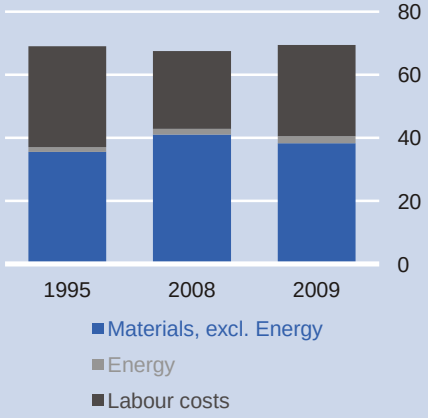
At first sight, the sector can do little to change its dependence on raw materials. For instance, producers have to use set quantities of ore, scrap and alloying metals in order to produce a kilogram of steel or non-ferrous metal. The laws of physics also mean that a minimum quantity of energy is required to smelt or heat up metals. Therefore, limits to efficiency increases exist.

However, the sector is continually developing new or improved alloys that lead to reduced consumption of materials and energy for their customers. For instance, the addition of zinc, tin, chromium, molybdenum or even tungsten can alter the characteristics – such as durability, strength, ductility, corrosion resistance and hardness – of metals. Improved manufacturing processes can also affect these characteristics. This enables a reduction in the alloy content, which can save costs.

For example, an increased proportion of tungsten and molybdenum allows the reduction of the thickness of the walls of pipes in power stations. Also, increasing the nickel content improves temperature resistance, which enables power stations to work more efficiently and therefore reduces CO_2 output. Offshore wind turbines are another example. A cupronickel casing on the steel piles increases their resistance to sea water and fouling. It also allows the use of thinner steel piles, as they no longer corrode. All of this directly reduces the cost of wind turbines and so, indirectly, the cost of renewable energy.

Materials and energy efficiency in the metal industry is continually being improved. For example, foundries are increasingly basing the design of their products on biological models. Mouldings based on biological forms only put material where it is actually needed, e.g. on critical welds. Plant engineering is also creating opportunities for increased efficiency in the metal industry. For instance, waste heat from processes is increasingly being recovered and, arc furnaces are being replaced by more efficient induction furnaces for small quantity production. The energy needed to move heavy castings can also be sharply reduced by redesigning internal logistics, e.g. with the aid of a track system.

High share of labour costs
Manufacture of metal products, % of gross production value



Source: Federal Statistical Office 11

Manufacturers of metal products are important customers

The metal products sector is an important customer of the metal manufacturing sector. By sector comparison it is very labour intensive (staff costs accounted for 28.9% in 2009, 31.9% in 1995): the industry average is only 19.8%. In contrast, material costs account for only 38.3% of gross production value (1995: 35.5%), somewhat below the average for manufacturing industry (43%). The proportion of energy costs is low (2009: 2.2%; 1995: 1.6%).

The sector manufactures a variety of different products, such as metal fabrications, metal tanks, radiators, boilers or tools. As the companies use very differing production technology and processes, there is a wide range of approaches for increasing material efficiency. According to a study by the Fraunhofer Institute[5], it is

[5] Arthur D. Little. Fraunhofer-Institut für System- und Innovationsforschung und Wuppertal Institut für Klima, Umwelt und Energie (2005). Studie zur Konzeption

Metal manufacturing

Important raw materials:

NF metals, iron ore and scrap steel, energy, coking coal

Negative:

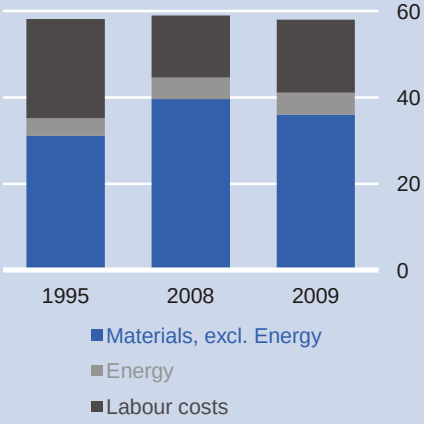
— Very high proportion of material costs
— Very high proportion of energy costs
— Oligopolistic structures of some of the relevant raw materials markets
— Uncertainty of planning due to increased price volatility
— Substitution of raw materials scarcely possible

Positive:

— Innovative metal alloys save material
— Higher selling prices often enforceable, as customers frequently have no possible substitutes and material costs are often less relevant
— Mining projects could limit raw material price increases

Increasing share of material costs

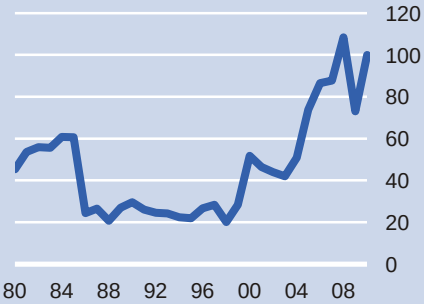
Manufacture of chemical products, % of gross production value



Source: Federal Statistical Office 12

Oil price reaches new heights

EUR basis, 2010=100



Source: HWWI 13

possible to achieve considerably higher material efficiency. For example, mathematical procedures applied as early as in the planning phase could show where materials or processing stages can be saved.

Metal industry heavily strained by the commodity boom

For metal manufacturing, the total proportion of material and energy costs is the highest of all German industrial sectors. Rising and volatile commodity prices therefore put above-average strain on the firms. In addition, there is stiff competition for basic steel and NF alloys in the sector. However, new and improved metal alloys provide consumers with added value, compared with standard alloys, and often allow the metal producers to pass higher costs on to their customers. Also in many applications there are not yet any substitutes for steel as a raw material which also stabilises demand. Overall, however, the risks of a commodity boom could outweigh the opportunities for the metal industry.

Chemical industry

The proportion of material costs incurred by the chemical industry was 36% in 2009 (1995: 31.1%), and was therefore below the average for manufacturing industry (43%). In contrast, the manufacture of chemical products requires above-average energy input: 5.1%, compared with the average of 2.4% for manufacturing industry. The proportion of energy costs is also almost 1 percentage point higher than it was 13 years ago. In the same period, the proportion of labour costs fell from 23% to 16.9%.

Like the metal industry, the German chemical industry is mainly a supplier of intermediate goods. Only 14% of German production (for instance paints, varnishes and detergents) goes to end users. The large remainder goes almost exclusively to industrial customers. Chemical manufacture has a high degree of vertical integration, as the raw materials are mostly broken down into their chemical components in large, continuously-operating chemical plants. These components are then processed into higher-value chemical products, mainly by small and medium-sized companies. The chemical industry's most important customers are plastics processors, metal firms and companies in the automotive and construction industries.

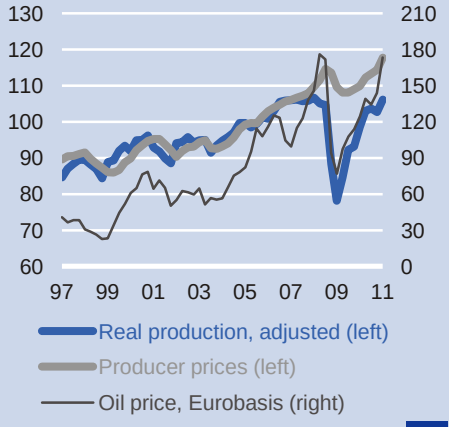
No replacement for petroleum in sight yet

The sector's relatively low proportion of material costs conceals its heavy dependence on a single raw material. Looking at the raw material basis of the chemical industry, by weight over 70% of this comprises petroleum and/or products made from it. The remainder, just under 30%, is made up by roughly equal proportions of natural gas and renewable materials like sugar, fats and oils. Coal is only used in very small quantities, as a source of hydrocarbons, the most important chemical bond for chemical production. The price of oil increased almost fivefold between 1995 and 2008. In the long term, the price could increase further, due to the high rate of growth in the emerging countries and the increasing difficulties of expanding supply. In consequence, firms are looking for viable alternatives to their dependence on oil.

Increasing importance is therefore being placed on the supply of renewable raw materials. For example, biodegradable plastics are

eines Programms für die Steigerung der Materialeffizienz in mittelständischen Unternehmen.

Chemical firms pass on rising oil prices
Manufacture of chemical products, 2005=100



Sources: Federal Statistical Office, HWWI 14

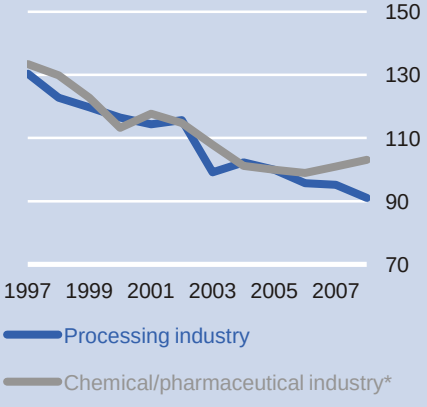
being made from maize starch and industrial sugar is being used to produce motor oils. Although, from a technical point of view, there is already a range of instances where crude oil can be replaced, frequently there is still a lack of price competitiveness for petroleum-based processes. Products made from renewable raw materials are therefore mainly still niche products, although they will steadily become more important due to strong public interest. As long as renewable raw materials are unable to compete on price, they will continue to be mainly used for the production of detergents and personal hygiene products, where, from a technical point of view, they cannot be replaced by other raw materials such as oil. In the medium term, greater advances in the use of renewable raw materials can be anticipated, in particular as a result of increased biotechnology research which looks for industrial scale transformation processes for biomass, following examples from nature. In the long term, therefore, a bioeconomy could develop, mainly using biomass as raw material. However, this requires the procurement of biomass to be secured – something that, taking into account the increasing global population and resultant growth in the demand for foodstuffs, presents a challenge in its own right.[6]

Biotechnology not only aids the increased use of renewable raw materials; it also makes possible some enormous advantages in efficiency. For example, the manufacturing process of Vitamin B2 is direct, avoiding the previous detours through 8 stages of synthesis. This in turn reduces the raw material requirement by 60%; CO_2 output by 30%; and the volume of waste by 95%. It also reduces costs by 40%. Such successes may occur more often in the future, thanks to increasing investment in biotechnology research. Germany is well positioned in this field of research, although it is trailing the USA, the UK and Japan.[7]

Renewable resources: only in the long-run an alternative

Scientists consider that CO_2 may be another alternative source of raw materials, at least in the medium to long term. Work is currently under way, for example, on the use of CO_2 in industrial quantities for the production of polyurethane foam. The process, which has so far only functioned under laboratory conditions, should be ready for the market by 2015. If, one day, a cheaper process for separating CO_2 from exhaust gases or from the air is developed, the method could also be used in the production of other – although not all – plastics. This would help reduce the dependence of the German economy on petroleum and natural gas imports.

Production has become less energy-intensive
Energy intensity, 2005=100



* based on VCI energy consumption monitoring

Sources: Federal Statistical Office, VCI 15

Improved process engineering lowers costs

However, firms in the chemical industry are also continuing to invest in more efficient traditional production techniques. According to the VCI, between 1990 and 2008 the sector increased its production by 58% while nevertheless reducing the associated energy use by 18% and greenhouse gas emissions by 37%. The energy intensity of production was therefore considerably reduced. Large-scale plant construction, with advances in design and plant operation, contributed a great deal to this. This allows, for instance, combined production, in which many chemicals are produced in connected installations where the waste heat and waste products of one chemical process can be more easily utilised in other processes. In

[6] See: Schaffnit-Chatterjee, Claire (2011). Where are food prices heading? Short-term drivers, trends and implications. Current Issues. DB Research. Frankfurt am Main.

[7] See also: Rakau, Oliver (2011). Deutschlands Biotechnologieregionen. Konzentration setzt sich fort. Aktuelles Thema 503. DB Research. Frankfurt am Main.

Chemical industry

Important raw materials:

Crude oil, renewable raw materials

Negative:

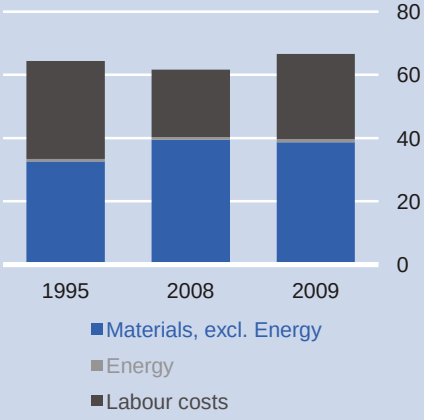
— High dependence on imports of oil
— Very high proportion of energy costs
— So far few possible substitutes for oil
— Basic chemicals at risk from raw material price shocks

Positive:

— Good opportunities to pass on price increases: low risk of substitution by customers
— Plastics are substituting for some metals
— In the future, biotechnology could reduce dependence on oil

Increasing share of material costs

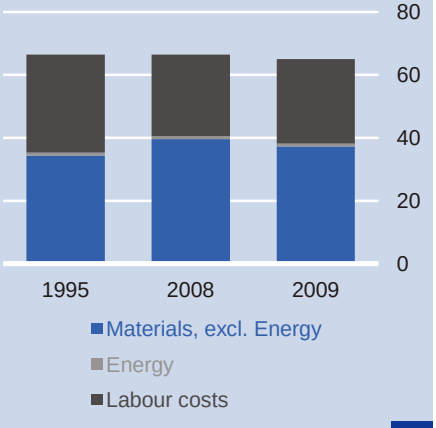
Manufacture of IT, electronic and optical products, % of gross production value



Source: Federal Statistical Office 16

Slightly higher share of material costs

Manufacture of electrical products, % of gross production value



Source: Federal Statistical Office 17

large-scale plants the potential for increased materials or energy efficiency has been exploited for some time due to high energy and oil prices. There is also strong international competition at this stage of production. Further leaps in efficiency are therefore not anticipated at the moment, though gradual advances certainly are. In the processing firms, which are smaller on average, the potential for increases might be greater. Micro process engineering, in particular, offers further potential for savings in this area, particularly in the small to medium volume segment. This will ultimately result in reduced waste production, an increase in the output of the chemical process and a reduction in operating temperatures, with a corresponding reduction in energy consumption.

Advances in the chemical industry – similar to those in metal production – provide its customers with major potential for increased material efficiency. This is because new and improved properties of modern chemical products can aid savings in materials and energy throughout their whole lifetimes. Examples of this are highly insulating materials for buildings, self-repairing plastics and detergents based on new types of stain-removing enzymes, which also curb water and energy requirements.

Overall, the chemical industry, in particular basic chemicals, is heavily burdened by increasing raw material costs, due to its unbalanced dependence on oil as a raw material and its very high energy requirements. Although the chemical industry increased its materials and energy efficiency, it was not able to compensate for the very high rate of growth in fossil fuel prices and further efficiency gains are likely to be moderate for the time-being. In addition, renewable raw materials will not be an adequate alternative to fossil raw materials for the foreseeable future. However, the sector can normally pass on higher prices to its customers and will experience a moderate boost in demand due to the movement towards lighter materials, such as plastics.

Electrical engineering

The electrical engineering sector comprises two major industrial divisions: the manufacture of computer, electronic and optical products; and the production of electrical equipment. The electrical engineering industry is very labour-intensive. In 2009 labour costs accounted for 26.9% on average (1995: 30.4%), compared with 19.8% for manufacturing industry overall. Energy costs (1% in 2009, 0.9% in 1995) are scarcely significant. As in most sectors, however, material costs have become more important. Their proportion of total costs rose from 33.7% in 1995 to 37.8% in 2009.

Firms in the sector manufacture a very wide spectrum of products, including computer chips, home electronics, electric motors, accumulators and household appliances. The panoply of raw materials and primary products used is correspondingly heterogeneous. Therefore, in the same way as the metal products sector, there is no single starting point for increasing materials efficiency. On the contrary: for this target the research and development departments of the firms in each product group would need to optimise design and production processes individually, working together with suppliers, customers and, if necessary, external research facilities. At first sight this admittedly appears to be very costly. However, the sector does not only work with large quantities of freely-available metals, such as lead, aluminium and copper, which may appear cheap in comparison with the costs of more sophisticated production techniques. Many products also

Rare earths: Not rare, but production is heavily concentrated*

"Rare earths" is the description of a group of raw materials that includes 17 elements, e.g. neodymium, lanthanum and cerium. These are particularly required for electro-technical products (e.g. lasers, LEDs and computer chips) and for climate-friendly technologies. For instance, lanthanum is used for the production of optical lenses for cameras and neodymium is an important constituent of the high-performance magnets that are important for electric vehicles and powerful wind turbines. Actually, these elements are not rare in the Earth's crust: they occur much more frequently than gold. However, their concentration in ore is low, so that, compared with other raw materials, considerably more material has to be shifted in order to produce the same quantity. Extraction costs are therefore a more important cost factor for rare earth mines than for other raw materials.

In China, low labour costs and environmental standards make extraction particularly inexpensive, which is why it produced more than 90% of the global quantity in 2008. In 2010, however, China sharply restricted its exports, in order to secure the metals for its own high-technology sectors. This caused a further price hike, since demand has sharply risen in the last few years, forcing up prices. The export restrictions have recently been somewhat relaxed. However, high world market prices are making extraction (once again) attractive in other parts of the world. As a result, disused mines in the USA and Australia are being put back into operation. In addition, there are deposits in Norway and Greenland that could be exploited. However, the lead times for such projects are long, typically 5-10 years, which is why an increase in supply that would dampen prices is not expected until at least the medium term.

*See: Albrecht, Jutta, Ursula Triebswetter und Jana Lippelt. Kurz zum Klima: Seltene Erden (2010). Ifo Schnelldienst 63(22).

Electrical engineering

Important raw materials:

NF metals, plastics

Negative:

— High supply risk for many critical raw materials (niobium)

— Frequently a lack of possible substitutes (lithium)

Positive:

— The change in energy policy is giving rise to investment in energy infrastructure and renewable energies (networks, energy storage devices)

— Increased demand for energy-efficient technologies (LEDs, heating control systems)

— Increasing long-term requirements for electronic components for electric cars

— Low proportion of material costs

contain the previously-mentioned rare earths, such as neodymium, which is essential e.g. for wind turbines. Precious metals such as platinum and even tungsten are also processed. The European Union ranks these as critical raw materials, having high economic importance and at the same time a relevant supply risk (see chart 20), because there are only a few, often politically unstable, supplier countries. Firms that can reduce the use of these raw materials, or even replace them with less critical ones, could achieve lower material costs and/or increased security of supply.

However, the potential for higher material efficiency is not limited to manufacture: the products of the electrical engineering industry can also contribute to reducing the consumption of materials and energy by its customers. For instance, modern LED and halogen lamps are highly energy-efficient and therefore save costs for their users. In addition, the electrical engineering sector supplies many components for the new renewable energy sector – from wind turbines through to solar panels. As a result, in the final analysis less fossil energy feedstock will be needed in coming years than would have been required without the input of electrical engineering. Another example is more efficient accumulators, which could give a boost to the breakthrough of electric vehicles beyond rail transport.

Positive net effect for electrical engineering

The relatively low proportion of material costs in electrical engineering suggests that the dependence on raw materials is limited. However, for some of their products the firms in the sector need small quantities of metals involving high supply risks. In the medium term, thanks to investments in new extraction sites, these risks should diminish. Nevertheless, the prices of the so-called rare earths could remain high: they are used in many cutting-edge technologies that help to save energy and to obtain it from renewable sources. This positive influence on demand should mean that the net effect of the raw materials boom is positive for electrical engineering.

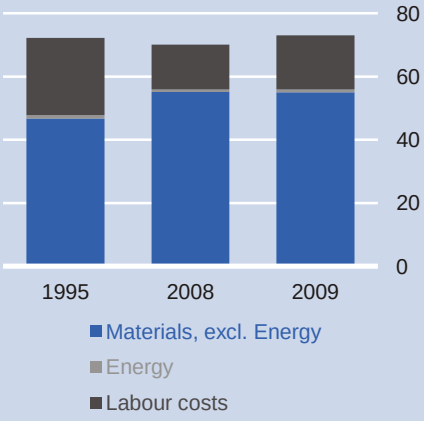
Automobile sector

In 2009, the automotive industry recorded the highest proportion of material costs (55%, 1995: 46.7%) of all the German industrial sectors. By sector comparison, both energy (0.9%) and labour (17.2%) costs are relatively low. However, suppliers to the auto industry, e.g. the chemical and metal production industries, notch up high proportions of energy costs, which are reflected in the trends of prices for primary products. Back in 1995, labour costs accounted for as much as 24% of the gross production value of the automobile sector. The decline in the proportion of labour costs has therefore been sharper than in most other sectors.

More lightweight construction for lower fuel consumption

An increase in lightweight construction is an important starting point for firms in the sector to reduce their consumption of materials. Lower production costs are only one factor in this: lighter vehicles are another, even more important reason. As already described, they allow fuel consumption to be sharply reduced. Due to the incipient electrification of the power train and the so far still inadequate range of electric cars, reduced vehicle weight has therefore become even more desirable. The sector is primarily adopting lightweight construction, i.e. the replacement of steel by lighter materials such as light alloys, plastics, technical textiles and carbon fibre. The first two of these are already being used to replace

Increasing share of material costs
Automotive industry, % of gross production value



Source: Federal Statistical Office 18

bodywork parts or chassis elements in many traditional production vehicles. In contrast, auto components made of extremely light and stable carbon fibre are still a rarity. Their manufacture is highly cost intensive, as it involves much manual work. The anticipated surge of substitution in vehicle building, through to the use of composite components even in large-scale production, is an enormous opportunity and challenge for mechanical engineering and automation specialists in Germany. If this problem can be solved, the material would certainly quickly achieve a breakthrough, instead of "only" being used in newer generations of aircraft, racing cars and expensive niche products.

There are still major weight reduction possibilities for the traditional material, steel. New, high-tenacity steels from the metal industry are enabling the construction of thinner sheet metal and lighter chassis parts, with similar or even better resilience. This is also aided by the easier formability of modern steels, which allow more complex structures. New production processes also allow the weight, and therefore the quantity, of processed steel to be reduced. The so-called hybrid forges combine forming and assembly of solid and sheet elements in one process. Lighter sheet elements, for instance, are used in areas where they are less heavily loaded, while solid components in load-bearing areas provide adequate stability. In the medium term, with this technique even different materials, such as carbon fibre and steel, can be combined in one component, which could give additional impetus to lightweight construction. In the future, a mixture of materials is also likely to be used for bodywork parts. The industry is showing the first signs of using "sandwiches" of thin sheets and plastic. These should provide competition for aluminium parts: although they are somewhat heavier they are also considerably cheaper.

Lightweight construction for cars still has great potential

Trend to electric vehicles changing raw material requirements

The change from internal combustion to electric motors should reduce the CO_2 intensity of transport and also make the sector less dependent on oil as a raw material. However, the manufacture of an electric motor requires major use of scarce NF metals, used in motors and accumulators, whose production requires considerable amounts of energy. For example, according to the German trade association of NF metal producers, the quantity of copper required per car primarily for the power train could rise by 150%, that of aluminium by 40% and nickel by 100%. This provides an example that many successes on the way to increased material and energy efficiency first require an "investment" in the form of expenditure on raw materials and energy, which then pays for itself over the life cycle of the resulting end product.

Automobile industry

Important raw materials:

Steel, NF metals, plastics

Negative:

- Very high proportion of material costs
- Lighter materials are still mostly too expensive at current fuel prices
- Long term changeover to electric motors drives demand for NF metals

Positive:

- In the future, very light materials such as carbon fibre could displace metals
- Lightweight construction saves fuel
- Good negotiating position with suppliers due to increased market power
- Customer's dependence on fossil fuels can be reduced in the long term

Value-added chains decisive for solutions

The example of cars shows that cooperation by firms along the value-added chain is required in order to develop innovative industrial solutions for material and energy efficiency problems. In this respect, German industry has a lead over many other countries.

Overall, increasing commodity prices put pressure on margins in the sector at least in the short to medium term. This is because materials are an important cost factor in vehicle building, when compared with the average for manufacturing industry. Admittedly this effect will be ameliorated because vehicle builders, as important buyers, enjoy a degree of market power. In addition, cooperation with upstream sectors in Germany offers considerable potential for

reducing material consumption in production, which will be even more attractive the faster raw material prices increase. On balance, the effects on the sector could be neutral or even slightly positive.

Cost structure of German Industry

Manufacturing sector		Gross production value (GPV), bn EUR			Gross value added, bn EUR			Materials consumption, excl. energy, % of GPV			Energy consumption, % of GPV			Labour costs, % of GPV		
WZ2008		1995	2008	2009	1995	2008	2009	1995*	2008	2009	1995*	2008	2009	1995*	2008	2009
10	Manufacture of food products	89.7	141.8	129.0	19.5	25.1	25.4	53.6	57.0	54.5	1.7	2.4	2.6	14.6	11.7	12.9
11	M. of beverages	22.7	19.9	18.7	8.2	6.2	6.2	29.6	38.5	36.6	1.6	2.8	2.8	15.1	15.2	16.5
12	Tobacco production	15.1	17.3	17.0	10.1	11.3	11.4	13.7	3.8	3.8	0.3	0.3	0.3	5.3	4.3	4.5
13	Manufacture of textiles	16.4	11.6	9.3	5.2	3.4	2.7	40.6	43.3	41.1	2.7	3.7	3.9	26.3	22.9	24.9
14	M. of wearing apparel	11.6	8.5	7.5	3.3	2.2	1.9	36.2	39.4	36.3	0.6	0.6	0.6	21.7	17.3	18.0
15	Manufacture of leather and related products	3.7	2.6	2.1	1.1	0.7	0.6	45.9	41.5	40.7	1.0	1.0	1.0	23.4	18.5	20.2
16	M. of wood and products of wood/cork	15.9	18.3	15.7	5.3	4.2	3.6	41.9	51.2	49.7	2.1	3.4	3.8	25.3	16.3	18.2
17	Manufacture of paper and paper products	26.6	38.6	34.1	7.9	9.3	9.0	43.5	45.7	41.3	4.7	7.1	7.3	21.1	16.5	18.1
18	Printing and reproduction of recorded media	35.8	18.0	17.2	15.4	6.3	5.8	26.7	36.7	37.9	1.0	2.4	2.4	31.1	26.6	27.6
19	Coking and petroleum refining	59.4	134.2	103.5	21.5	38.2	34.5	23.8	46.6	38.3	1.0	0.6	0.8	2.9	1.3	1.7
20	Manufacture of chemicals and chemical products	97.9	137.6	120.0	31.5	33.1	29.8	31.1	39.6	36.0	4.1	5.0	5.1	23.0	14.4	16.9
21	Manufacture of pharmaceutical products	18.5	43.2	39.5	7.3	16.7	15.5	24.3	22.0	22.9	1.0	1.2	1.3	27.8	19.6	19.4
22	Manufacture of rubber and plastic products	45.9	69.8	58.4	16.7	21.0	18.3	37.1	41.5	39.2	2.3	2.6	3.0	27.1	21.3	24.4
23	Manufacture of other non-metallic mineral products	38.2	39.2	34.7	15.3	12.5	11.2	28.0	32.0	31.3	5.2	7.2	7.4	26.8	22.1	23.7
24	Manufacture of basic metals	55.1	116.3	72.7	16.4	23.6	15.8	44.1	55.5	51.7	7.1	6.0	8.3	22.6	12.2	17.2
25	Manufacture of metal products	66.5	105.8	80.6	26.5	36.3	28.8	35.5	41.0	38.3	1.6	1.9	2.2	31.9	24.6	28.9
26	Manuf. of IT, electronic and optical products	54.5	80.6	55.3	17.1	22.7	16.8	32.8	39.5	38.7	0.8	0.8	1.0	29.7	21.3	25.9
27, excl. 27.5	Manufacture of electrical equipment, excl. household appl.	71.9	106.8	93.0	26.4	29.9	27.2	34.3	39.6	37.2	1.0	0.9	1.0	31.1	25.9	27.5
28	Mechanical engineering	131.3	237.7	181.1	50.2	74.8	57.3	37.8	43.2	41.7	1.0	0.9	1.0	32.8	23.1	28.0
29	Manufacture of motor vehicles and components	144.3	344.0	269.8	42.9	59.0	43.8	46.7	55.1	55.0	1.1	0.8	0.9	24.4	14.2	17.2
30	Manuf. vehicle building	16.9	31.6	30.3	5.7	8.8	8.1	41.5	45.3	47.6	1.2	0.8	0.8	38.2	23.4	24.8
31	Furniture manufacture	20.1	20.2	16.1	7.1	6.0	5.2	42.5	48.0	43.4	1.2	1.3	1.4	29.4	22.5	25.3
32	Manufacture of misc. goods	12.7	21.2	20.9	5.6	8.2	8.3	28.5	29.7	27.0	0.9	1.0	1.1	34.2	26.7	28.1
33	Repair and installation of machines and equipment	-	30.5	31.7	-	9.5	9.9	-	38.8	37.5	-	0.7	0.8	-	25.1	28.1
	Manufacturing industry	**1094.3**	**1795.3**	**1458.1**	**378.5**	**472.2**	**400.2**	**37.4**	**45.4**	**42.9**	**2.0**	**2.1**	**2.4**	**24.8**	**17.1**	**19.8**

* The figures for 1995 and 2008 are not directly comparable, due to the Federal Statistics' Office new sector differentiations.
In order to make the data easier to compare, some of the 1995 figures have been adjusted.

Sources: Federal Statistical Office, DB Research 19

Intelligent resource policy indispensable

Raw materials only ostensibly an easy field of policy

Raw materials are a difficult policy area

At first sight, the subject of raw materials appears to require relatively simple, unambiguous adaptation strategies, such as efforts to save on usage, or substitution. The challenges are actually more complex than that. The first problem is that, in view of their production, utilisation and distribution aspects, raw materials are an extremely inhomogeneous group. Three characteristic features at best are a common denominator: firstly the origin of the materials is close to nature and to the associated primary production, such as mining, fisheries, forestry and agriculture. Secondly there is, at most, a small amount of processing and treatment. Thirdly, raw materials typically "disappear" when they are utilised. For instance they are lost by being consumed (e.g. food) or as an input factor of production (e.g. vehicle components).

Resource policy must fully understand raw material topic

Complexity is often underestimated

Apart from the few common factors, resource policy is an extremely complex field of policy. Even the term “raw materials” is open to many interpretations. There is already considerable leeway for defining the “breadth” and “depth” of the concept of “raw materials”. Specifying the “depth” begs the question of how much treatment and/or processing is allowable. Typically, there is a differentiation between raw materials, intermediate products and end products. For policies that comprehensively address the topics of raw materials and their supply, the widest possible breadth and depth is advisable.

Used materials with unused potential as a source for raw materials

As waste, reject and – when they are reused – scrap materials find their way back to the start of the manufacturing process; it makes sense to classify them under the term “raw materials” as well. In practice, primary and secondary raw materials are therefore differentiated in this context. Particularly for industrialised countries such as Germany, the reutilisation of waste materials is especially attractive. The systematic use of secondary materials usually leads to considerable cost savings. A policy that promotes recycling of secondary raw materials is therefore definitely also a resource policy. For example, large amounts of energy are required for the original production of paper and NF metals, such as primary aluminium. In contrast, recycling these materials from “used” end products requires much smaller quantities of energy. It is therefore not surprising that German industry has increasingly focused on secondary materials in the last few years, incorporating as additional sources of raw materials the “blue bins”, used to collect household waste paper, and collecting points for scrap cars. For instance, according to the BDI (Federation of German Industry) the steel industry used almost 45% of secondary raw materials in 2006. The proportion of plastic waste reused for materials was similarly large. This resource policy has many advantages for the economy: it reduces the bill for raw material imports and increases the security of procurement of raw materials (e.g. in comparison with imports from countries that are in crisis). It is also good for the environment. The amount of energy required is low compared with primary production and the recycling leads to smaller quantities of waste overall.

Horizontal distribution also important for resource policy

Many resource policies apply to the breadth or horizontal aspects of the term “raw materials”, for example to facilitate the substitution of

raw materials. Of particular importance in this respect are common features such as the origin of the raw material concerned (e.g. mining, agriculture or forestry) or its particular application (e.g. as an industrial input or as a consumer good). Resource policies can correspondingly be differentiated according to their point of application, i.e. industrial or non-industrial raw materials (e.g. food and beverages). Particularly in the industrial sector, it is possible to make numerous distinctions and therefore bases for policies, e.g. energy and non-energy raw materials; or ferrous and NF metals. Going a stage further, NF metals, for instance, can be classified into light, heavy and precious metals, steel stabilisers and alloy metals. All this suggests that policies relating to individual raw materials or groups of raw materials could be highly multifaceted.

Regional concentrations often pose problems

Depending on the raw material concerned, the often widely-differing distribution of deposits and costs of extraction not infrequently cause conflicts. This can affect not only importers' pricing but also the security of supply for entire national economies. Regional concentrations always pose particular problems if, for technical and/or economic reasons, a substitute for the raw material cannot be used. For example, regional concentrations enable not just cartelisation of supply and the exercise of supplier power but also the exertion of other forms of political or economic influence. China's conduct with the trade in rare earths is only the latest example. The spectrum ranges from national monopolies through to international cartels.

Resource policy should pursue a whole package of objectives

The history of the raw materials trade features a multitude of problem areas and international conflicts. We consider that there is no ideal solution for coping with the looming and varied resource problems. Only a package of measures and initiatives may make it possible to come to terms with raw material problems. From the point of view of the industrialised countries, resource policy should pursue at least four objectives:

Firstly guaranteeing or increasing the security of supply should be an important objective and the appropriate framework should therefore be put in place. This is simpler for easily storable raw materials, such as metals and solid or liquid energy sources, than it is for e.g. foodstuffs, which are normally perishable and therefore have only limited keeping qualities.

Secondly the resource policy must commit to environmental objectives. Many aspects are relevant in this respect. They range from environmentally friendly mining and transport of raw materials, through to efforts to make savings. For instance, energy consumption should be reduced at all levels, from manufacture through to personal transport. An example of this is the EU climate and energy package 20-20-20 that, not least, is endeavouring to create energy savings of a fifth by 2020. In addition, incentives for collecting and recycling waste materials should be offered: these also save resources.

Thirdly economic efficiency should be aimed for. Normally, for individual firms the focus is on optimising the value-added chain and on the supply of raw materials. For the economy as a whole, the first task of regulatory policy is to enable, or to improve, the functionality of raw material markets. One instrument for this was the establishment and organisation of raw materials exchanges, for

Examples of raw materials cartels and monopolies

Natural monopolies started very early on. A good example of this is the market for natural rubber. Until the end of the 18th century this was actually dominated by South America, as the Para rubber tree was only found there. For many years the entire region profited from this unique global selling point. Its quasi-monopoly was finally smashed by a combination of several influences: successful smuggling of seeds abroad (then subject to the death penalty); subsequent breeding successes and plantations in Asia; and the always poor productivity of soils in Brazil, which caused the country to sink to the status of a marginal supplier.

Petroleum is a well-known example of the **international cartelisation** of a raw material market and the exercise of market power. Since its founding in 1960, the policy of the OPEC supply cartel has influenced the oil price and therefore also demand. Even after 50 years, OPEC's time is in no way over. Quite the opposite: following an increasing relative shortage of the most important energy feedstock (in terms of quantity) in coming years, a strengthening of the cartel and further considerable price increases are to be expected.

However, subsequently many other raw materials markets have been subject to cartelisation and/or the exercise of political influence. A legendary example is the International Tin Agreement the origin of which, well before OPEC, dates back to the Bandoeng Pool, a cartel-like supply union in 1921. The Tin Agreement was very innovative: even in its early days it attempted to create a balance between raw-material-rich developing countries (who owned the tin) and the industrialised countries, comparatively lacking in raw materials, which needed it. In the time between its founding in 1956 to its breakdown in 1985, the aim was to balance and harmonise the interests (i.e. on the bottom line prices and quantities) between the countries. On balance, however, the agreed – and ultimately too high – tin prices resulted in growth in tin being held back compared with the other NF metals (e.g. copper, aluminium) or other substitutes. This in turn, however, also reduced the potential sales by the tin countries. It is not surprising that such agreements, which for a long period were regarded as aspiring, **modern resource policy**, are no longer aimed at – at least in their then form.

Consumers should also make savings

trade in the spot and forward markets of homogeneous raw materials. In the wake of liberalisation, for example, energy exchanges were founded in Europe. The exchanges enable more efficient formation of prices than barter or individual contracts; they therefore widen the information basis for market participants.[8] Secondly, the policy should establish intelligent incentives that result in more efficient use of raw materials in industry and also steer consumers' habits toward thrifty – and therefore economic and considerate – use of raw materials. In this respect, for example, taxation of energy consumption is expedient.

Fourthly the sustainability of raw material consumption should be promoted, in the interests of improved distributive justice. From an economic point of view, there are at least two dimensions to the distributive objective. To be precise, it does not only involve the promotion of exchange between all global regions: it is also a matter of fairness between generations, i.e. so that future generations will also have access to exhaustible resources such as petroleum.

Optimising the division of labour between firms and politicians

In market economies, firms, for the most part, take care of their raw material sources themselves and take the necessary action to ensure secure, dependable and reasonably-priced procurement. To that end, differing strategies are developed and differing scope for action is sought after and exploited. However, these reactions are in competition with each other and therefore influence the success of the industrialist concerned. Even in the global raw materials world, there are, however, natural limits to entrepreneurship, where individual scope for action is restricted or even exhausted. If the reasons for this are of a political nature, e.g. because supplier countries are exerting an influence on raw material trading and/or transport (e.g. by customs duties, quotas or other regulations), a long-term solution to the problem may only be possible by involving politics. As a rule, this offers additional scope for action and problem-solving measures especially at international level that are not accessible to individual firms. Particularly in resource policy, a division of labour between firms, their associations and the political decision-makers makes sense and is often the only basis of successful business in the global economy.

German industry suggestions for increased raw material security

Securing the procurement of raw materials for German industry is primarily a task for the firms themselves. When the limit of corporate negotiations is reached, the politicians can and should take advantage of their sphere of influence. The Federation of German Industry (BDI) for example is calling for:

- The combating of unfair trading and unfair competition in raw materials using all promising political methods
- The securing of functioning competition on raw materials markets
- The establishment of appropriate incentive structures for increased material and energy efficiency
- Improvement of the conditions for the use of secondary raw materials
- Support for German and European firms undertaking raw material projects abroad

See: BDI (2010).

German industry worried about metallic raw materials

At least since the second half of the last decade, German industrial firms' concerns have not only involved their energy feedstock. They are also viewing, with ever-increasing urgency, the necessity of securing more reliable procurement of basic metallic raw materials. This is substantiated not least by the various initiatives and publications of the Federation of German Industry (BDI), with the help of which the Federation is forcefully demanding support from the politicians. In our view, the sum total of these demands is entirely well founded.

Co-operation between firms and politicians required

Nevertheless, the origins of the present problems are by no means only in the raw materials countries: some of them are also home-made. During the last 30 years, for various reasons many well-known (German) raw materials firms have disappeared from the

[8] However, there are studies indicating that increased stock market trading in raw materials is responsible for prices that are beyond those justifiable by the fundamental data. See: UNCTAD (2011). Price formation in financialized commodity markets. The role of information. New York/Geneva. Möbert, Jochen (2009). Do speculators drive crude oil prices? Dispersion in beliefs as a price determinant. Deutsche Bank Research. Research Notes 32.

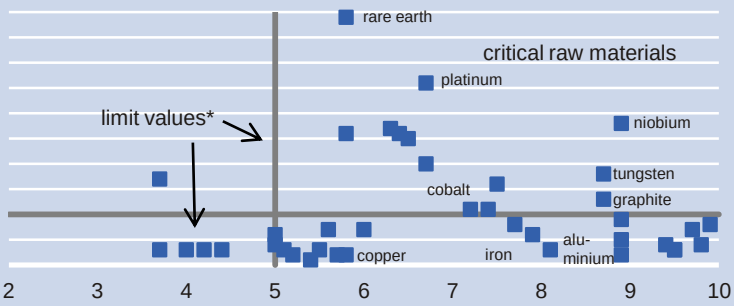
market. One of the main business objectives of these firms was to procure secure, reliable and relatively cheap imports of NF or precious metals for manufacturing industry (e.g. the automobile industry and mechanical engineering). The decline of these firms, at exactly the same time as the final disappearance of the Iron Curtain and the laying of the groundwork for the new growth centres in Asia, is certainly a very special episode in German industrial history. In the last few years, raw materials firms from China and also from North America and Europe (e.g. the UK and France) have increasingly taken advantage of new opportunities.

Some raw materials have high supply risk

As, in Germany, there are no longer any major raw materials firms in the areas concerned, the dependence of industry has increased in two ways during the last few years. As well as the dependence on typical supplier countries of the individual raw materials, which has always existed, there is now a new type of dependence – on the large international raw materials groups, their business methods and their market power. This is a disadvantage not least because, for example, the major new Chinese firms do not automatically have their sights on the global market: a major aim is still to cover domestic raw material requirements. As far as Europe is concerned, for example, the African petroleum reserves taken over are probably lost forever.

Only a few raw materials that are economically important also have high supply risk

x-axis: economic importance; y-axis: supply risk



* Limit values over which the EU assesses the raw material as having very high economic importance or the supply risk is assessed as high.

Source: European Commission 20

Industry initiatives for increased raw material security make sense

EU should accept its special responsibility

From today's perspective, the latest industrial initiative is well overdue. To increase raw materials security, it promotes a cross-sector approach, combining important policy areas that include trade, foreign policy and foreign trade policy, European and even development policy.[9] EU policy in particular has a special role in this area.[10] The Europeans are attractive due to their excellent knowledge of mining techniques and infrastructure solutions. On the bottom line, the European market is also very large. Nonetheless, it is not usually possible for individual EU countries to lift or avoid barriers in the supplier countries without backup from other European countries. In the future member countries should enable the EU to assert the interests of all its members against individual

[9] For details c.f. BDI (2007). Rohstoffsicherheit – Anforderungen an Industrie und Politik. BDI (2010). Für eine strategische und ganzheitliche Rohstoffpolitik.
[10] See e.g.: EU (2010). Critical Raw Materials for the EU.

or, if necessary, organised raw material supplier countries. The era in which the large Western European countries were single-handedly able to achieve success on the world stage is probably past.

Close relations between raw materials countries helpful

Admittedly, in a few EU countries, traditional relationships, some of which date from the colonial period, still play a role. Nevertheless, in the important raw material supply countries, the Europeans are increasingly coming up against the strongly-expanding and financially sound emerging economies, particularly from Asia. As these new competitors usually do not attempt to pursue political objectives in the raw material supplier countries, they are often greatly welcomed.

EU policies aim to improve access to energy feedstock …

The EU is aiming for a competitive, sustainable and secure energy supply. Currently it intends to take initiatives in the field of external energy relations, with the aim of countering common energy policy challenges at international level. These include guaranteeing and improving the access to energy feedstock in non-member countries, as well as promoting global climate objectives and facilitating the import of renewable energy. The current Polish Council Presidency is taking these matters very seriously.

... and to make the consumption of raw materials more expensive

Raw material costs should reflect "true" costs

For some time, news items have been circulating about a strategy document on resource efficiency that the European Commission aims to present in the autumn. According to reports, in the document the Commission is demanding higher taxes on raw material consumption, because current prices do not reflect the “true cost of consumption” and therefore set false incentives for the use of resources. The Commission voted for raw material taxes that, on EU average, will rise to at least 10% by 2020. This would be a considerable increase, as currently only Denmark (12%) and Malta (11%) charge slightly more, while major countries exact substantially less. In Germany the starting point is 5%. As, on balance, the overall tax burden should not increase, offsets (e.g. lower income taxes) would be necessary.

From the point of view of industry, the important factor is where the taxes will be charged. If the tax is based on the raw materials input, the special tax will diminish competitiveness against rivals from non-EU countries. It would be different if only the end users in the EU were to be charged, as the sale prices of industrial products outside the EU would then be unchanged and markets there would not be restricted. In this respect, from an environmental point of view the taxation of non-EU products would also be advantageous. Competition between EU and non-EU producers would also not be distorted.

However, any discussion about the “true costs” has its pitfalls. In favourable phases of the economy, i.e. during upswings, higher taxation appears easier to push through, as lively demand can outbalance the additional costs. In weak economic phases things are very different: in crisis periods producers are glad to receive any orders. On balance, considering Germany as an industrial location, we envisage that additional taxation of raw material consumption, affecting the end consumer, is most likely. If necessary, there could be exceptions for individual raw materials (e.g. lignite) or products

similar to raw materials (e.g. water) that are rarely traded outside national boundaries.

Summary: Raw materials stay on the agenda

The bottom line is that, for German industry, the shattering effects surrounding raw materials will continue to increase. In practice, there is no way to avoid rising commodity prices. It is therefore important for firms to develop intelligent solutions. It is obvious that further efforts to save materials and more efficient production processes are necessary. In addition, attempts should be made to latch on even more to the latest trends, such as foreseeable increases in energy and metal prices, with economical products. The possibilities include the manufacture of fuel-saving cars, which owe their attractiveness in part to thin but nevertheless tough bodywork produced by the modern steel industry, and which are increasingly in worldwide demand. Electrical and mechanical engineering could also make contributions, however. For example, modern mining techniques facilitate access to metal or energy deposits in the producer countries. If important German industrial sectors, such as the automobile industry and mechanical engineering, take advantage of opportunities in expanding emerging and raw materials countries, they could be net gainers in global upswings, despite rising raw material prices.

The penetration of the major developing countries on the international raw materials markets and possible politically-motivated shortages in raw material supplies mean that closer cooperation with governments is unavoidable. This is the only way to secure the raw materials basis, for the long term and within acceptable limits, for many industrial sectors and private households. EU policy in particular has a special role, as otherwise the individual countries risk being played off against each other in a global and increasingly intense fight for raw material resources that, in the longer term, they may lose. The latest EU initiatives appear to be headed in the right direction and give a reason for optimism.

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